



D-2 INCORPORATED

**HYDRO-LIGHT
WATER PAD READER**

JF-WA1



**OPERATION MANUAL
REVISION 8.0
P/N 480-003**

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This manual covers the operational aspects of the D-2 JF-WA1 Hydro-*Light* Sensor. D-2 continuously strives to meet the full expectations of our customers and we welcome comments on the structure, content and the ability of this manual to answer your questions regarding our product. If you have any suggestions or comments, please contact us at Sales@D-2inc.com. This document is provided with the understanding that future versions of this instrument may have additional commands, and the function of the commands shown in this document may vary from the present operation.

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Notes for User:



WARNING!

There is a danger to life and limb or a risk of serious injury if the notes on safety are disregarded!



CAUTION!

There is a risk of injury and damage to property if the notes on safety are disregarded!



ATTENTION!

There is a risk of damage to property if the notes on safety are disregarded!



! IMPORTANT

Notes on working procedures.

Read the instructions in this manual carefully before installing or starting the system. Note throughout this manual the term JF-WA1 applies to all models of the instrument, unless specific individual model numbers are detailed.

D-2 Incorporated will accept no liability for damages due to non-observance of this manual.



ATTENTION!

If the instructions in the operating manual are not adhered to or are inadequately adhered to, there shall be no entitlement to services under the warranty.

Information in this manual is subject to change without notice and does not represent a commitment on the part of D-2 Incorporated.

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Where manuals are written in several languages, the text it was created in is considered the original.

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1.0 GENERAL DESCRIPTION

The JF-WA1 Hydro-*Light* Sensor incorporates innovative optics and electronics which use Digital Signal Processing (DSP) techniques to accurately determine the fluorescence of water detector test pads in accordance with ASTM D3240. The instrument will measure 1.0" test pads with free water in the range of 0 – 50 parts per million (PPM), although it is optimized and normally used in the 0 to 35 PPM range. The sensor displays the calculated value on the 2-line 2.25" x 0.90" Liquid Crystal Display (LDC), and also offers a USB data output.

Although absolute calibration relies only on the sensor's optical geometry, which is very stable by design, the Hydro-*Light* Sensor continuously monitors internal electronic circuits to guarantee calibration to be a maximum of a five year period. Ambient Operating temperatures are compensated through the use of a built-in temperature sensor and all calibration terms are stored in internal, non-volatile memory. D-2 Inc. also provides reference pad shuttle to verify readings between calibrations.

These attributes make the JF-WA1 very reliable and easy to use.

2.0 SPECIFICATIONS

Table 2
SENSOR SPECIFICATIONS

Parameter	Free Water
Range	0 – 50 PPM
Accuracy	+/- 0.5 PPM (+/- 2%) of Reading
Resolution	0.1 PPM
Sensor Type	Optical LED Driven
Calibration	Internal Zero & Scale

Table 3
SYSTEM SPECIFICATIONS

ELEMENT	SPECIFICATION
Environmental	15 to 35 °C Operation -10 to 60 °C Storage
Power	9.0 VDC ± 0.3 VDC, Use Supplied Power Supply Only
USB Power*	Option via USB Cable
Certification ASTM	D3240
Certification Sensor	CE

* Consult Factory for USB Power Option Input

3.0 USAGE

The use of the *Hydro-Light* to determine the free water content of fuel products, such as jet aviation and diesel fuels, should be conducted in accordance with ASTM's D3240 method.

A water detector test pad that has been properly prepared with a fuel sample (method D3240) is placed into a JF-WA1 shuttle and then placed into the *Hydro-Light*. The *Hydro-Light* calculates the free water content in parts per million (PPM), then displays the digital value on the top line of the LCD readout.

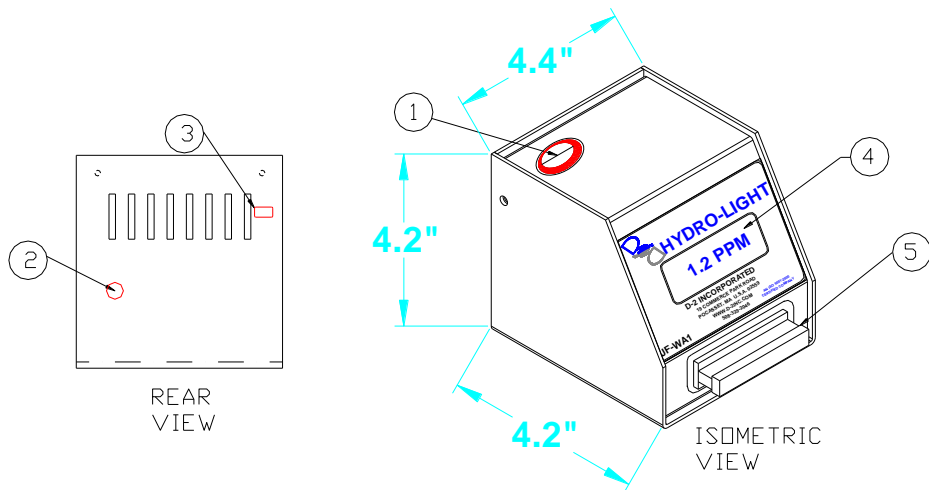
The bottom line of the LCD is used for displaying pertinent information. It toggles between the firmware revision, the last calibration (month/year) and the measurement mode.

The measurement mode of the JF-WA1 can be set to either "Mode A" or "Mode D". The Hydro-Light can apply the ASTM D6708 Bias found between the existing method sensor and the original Aqua-Glo® Instrument. The Bias was found to be $\text{Hydro-Light Reading} = \text{Aqua-Glo}^{\circledR} \text{ Reading} * 1.22$. This bias correction can be made by the Hydro-Light. If the lower display indicates "Mode A" then the correction factor has been applied internally in the Hydro-Light and the readings are equivalent to the present ASTM D3240 method (in other words the unit reads the same as an Aqua-Glo®). If the low information line indicates "Mode D" then the Hydro-Light reads in the original D-2 Incorporated Calibration and values from the unit must be divided by 1.22 to equal the current ASTM D3240 Method. Units are shipped in "Mode A" for user convenience.

4.0 THEORY OF OPERATION

The D-2 JF-WA1 *Hydro-Light* Sensor uses Light Emitting Diodes (LED's) to illuminate the water detector test pad, while it is inside the sensor chamber. The high-performance detector receives the fluorescent light reflected back from the pad. The instrument measures the amount of light received back to determine the concentration of free water which came in contact with the pad as a result of its exposure to the fuel sample. The display reads directly in PPM, and is scaled to the standard size 500 ml fuel sample as outlined in ASTM D3240. If an alternate amount of fuel is sampled through the pad the displayed number need only to be scaled by the ratio of the amount of fuel sampled to the standard 500 ml sample size.

Figure 1
Major System Components



- 1. On-Off Switch
- 2. Wall Power Adaptor
- 3. USB Port

- 4. Display (LCD)
- 5. Pad Shuttle

5.0 OPERATION INSTRUCTIONS

Step-by-Step Operation Procedure

1. Connect *Hydro-Light* power supply to power input on the rear panel of the unit (Figure 1) and plug into 90 – 340 VAC 50/60 Hertz outlet. (Or USB Cable with USB Power Option Consult Factory)
2. Turn the *Hydro-Light* unit on with switch at the top of the chassis (Figure 1). The display will illuminate. After 5 seconds, the top line of the display will show the text “*Hydro-Light*”. Allow the instrument to acquiesce to room temperature once power is supplied. We recommend a warmup period of at least 10 minutes. The *Hydro-Light* unit is now ready to use. The lower display will indicate the next factory calibration date.
3. If there is no pad present, the display should read “0 PPM”.
4. Remove the shuttle from the front drawer of the unit (see Figure 2).
5. Press down on the tab to open the shuttle cover (see Figure 3).
6. Using tweezers, insert the pad into the shuttle (see Figure 4). Ensure that the pad is centered in the recess of the shuttle.
7. Let the cover close to hold the pad in place.
8. Re-insert the shuttle into the *Hydro-Light* drawer.
9. Allow 5 seconds for the *Hydro-Light* unit to fully update the pad reading after insertion. The display number will momentarily flash each time an update occurs and the lower line will change displayed information.
10. Your *Hydro-Light* will now display the PPM free water content of your 500ml sample¹.
11. The *Hydro-Light* reads directly if the sample volume is 500ml. Correct the reading for other sample sizes by multiplying the displayed reading by (500/Sample size in milliliters).
12. Remove the shuttle, then remove the test pad from the shuttle and discard the test pad.
13. With the use of specially developed polymer Verification shuttle targets, factory recalibration can be as large as a five-year period. To verify calibration in the field, use the verification shuttle to ensure the readings are within the specified limits. If ever the Verification shuttle does not meet the printed specifications, contact D-2 Inc.

¹ Note: The *Hydro-Light* can apply the ASTM D6708 Bias found between the existing method sensor and the original Aqua-Glo® Instrument. The Bias was found to be $\text{Hydro-Light Reading} = \text{Aqua-Glo® Reading} * 1.22$. This bias correction can be made by the *Hydro-Light*. If the lower display indicates “Mode A” then the correction factor has been applied internally in the *Hydro-Light* and the readings are equivalent to the present ASTM D3240 method (in other words the unit reads the same as an Aqua-Glo®). If the low information line indicates “Mode D” then the *Hydro-Light* reads in the original D-2 Incorporated Calibration and values from the unit must be divided by 1.22 to equal the current ASTM D3240 Method. Units are shipped in “Mode A” for user convenience.

Figure 2



Figure 3



Figure 4



6.0 FIELD VERIFICATION PROCEDURE

Note: Verification is at the option of the user and will not change the calibration of the instrument. The instrument will remain calibrated over the entire calibration interval if use as described within this document is adhered to.

Step-by-Step Operation Procedure

JF-WA1 HYDRO-LIGHT VERIFICATION USING THE H&L-SHUTTLE Technical Application Note 11-008

The JF-WA1 Hydro-Light H&L Shuttle Option allows immediate verification of the Hydro-Light Calibration in the field. The H&L Shuttle has convenient low and high range color standards mounted one on each side. With the test pads fixed in the shuttle the user has far less handling of the verification pads keeping them cleaner and more protected. The H&L Shuttle has the verification values marked in PPM Water content on each side.

Note: The H&L Shuttle should be protected from sun light at all times to prevent bleaching of the color standards. The shuttle must not be left in the Hydro-Light reader to prevent bleaching of the color standards by long term exposure to the reader excitation LED light.

The Hydro-Light calibration is valid for a five-year period, if and only if the Verification shuttle reads within its specified values. Hydro-Light verification can be performed on any basis as needed by your facilities laboratory interval requirements. After a five-year period, the color standards should be replaced and factory calibration should be performed. In the event that the Hydro-Light fails to verify, a field calibration of the unit can be performed using the H&L Shuttle, consult Application Note 11-009.

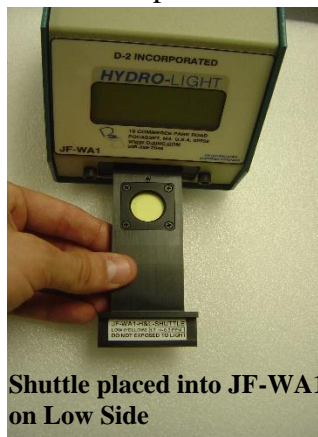
Procedure:

Remove the H&L Shuttle from its protective cover. Check the H&L Shuttle Calibration date is valid (labeled on end of shuttle). Also, ensure the serial number of the verification shuttle matches the serial number on the rear panel of the JF-WA1 being examined. Verification is performed simply by insertion of the H&L Shuttle into the Hydro-Light on each side. Confirm that the value displayed in PPM is within the range printed on the shuttle handle, then remove, turn over, insert and verify the second side in the same manner. Return the H&L Shuttle to its protective cover.

For More information please contact D-2 Incorporated.



JF-WA1-H&L-SHUTTLE



Shuttle placed into JF-WA1 on Low Side



Shuttle placed into JF-WA1 on High Side

7.0 USB SERIAL DATA INTERFACE

The JF-WA1 has an industry standard USB Interface. To properly connect to the sensor certain USB drivers are needed. These drivers may or may not be already loaded on your computer. These drivers can be found online from <http://www.ftdichip.com/Drivers/VCP.htm> and looking for the FT232R product line. This USB connection will have properties of a virtual serial port and the connection shall automatically be given a comport number. This Comport number will be needed for communications with the sensor through a Windows® terminal software program.

All instrument calibration constants and configurations are stored in internal non-volatile memory. The unit also has programmable optics temperature compensation constants.

7.1 Port Settings

When powered the unit commences operation to the USB Driver. The serial port will not be recognized by the host computer unless the JF-WA1 is powered and turned on.

The serial port should be configured for:

57600 Baud

8 Data Bits

No Parity

1 Stop Bit

No Handshaking

Consult your computer manual for USB port configuration and use.

7.2 Command Structure

(Note: Responses from the JF-WA1 are represented by 10 pt ARIAL Black Font)

(Notes: commands sent to the JF-WA1 are represented by 12 pt Arial Bold Green Font)

- All commands sent to the JF-WA1 are case **insensitive**.
- Each command must be followed with a carriage return <CR> (Enter key of the computer's keyboard).
- To read individual parameter the command name is entered followed by the <CR>. For example, to read the offset value, the command would be entered as **N2<CR>**.
- To set an individual parameter, you use the command name + the "=" + parameter value. For example, **N2=3.11<CR>**

7.3 Continuous Data

The JF-WA1 has the ability to output continuous data to the serial port. To have the unit send data continuously, send the **SC**<CR> command. The unit will commence sending data at the data rate and current averaging rate. To stop continuous data, resend the **SC**<CR> command.

7.4 Configuration/Calibration Constants

When not set in continuous data mode, the unit awaits user instructions such as calibration constants, or settings, etc. All instrument calibration constants and configurations are stored in internal non-volatile memory. See Appendix B for command definitions.

7.5 Calibration Mode

In CALIBRATION OPEN MODE the unit runs the same but adds an additional digit to readings taken and outputs the internal temperature to the display. This mode is entered by the command "TCAL<CR>". The SET CONTINUOUS "SC" command also operates in Calibration Mode. This mode is not stored in EEPROM as such power cycling will revert the unit back to normal operation.

8.0 CALIBRATION

8.1 Calibration Interval

The D-2 JF-WA1 Hydro-*Light* sensor should be calibrated by the factory, only. New target shuttles (polymer) have been incorporated to increase the calibration period to maximum of five years, if and only if, the shuttles read within their published specifications. Each shuttle has specifications printed on them. Each unit is "married" to the shuttle it was calibrated to, so that no other shuttle should be used as a verification. Each shuttle has the corresponding serial number to the married unit. The instrument has no internal electrical adjustments that need to be maintained inside this period and the housing should not be opened outside of the factory. Doing so voids the warranty.

8.2 Verification Tests

The best indicator of static operation of the sensor is the use of verification pads; see "field verification section" for complete instructions.

9.0 MAINTENANCE

NOTE: There are no user-serviceable components inside the D-2 JF-WA1 Hydro-Light Sensor. There are NO Electronic adjustments inside the sensor.

APPENDIX A: LIMITED WARRANTY

Subject to the limitations contained in "Limitation of Remedy & Liability" section, as shown below, Seller warrants that products provided will perform to the ability of the published specifications or Industry Method(s) claimed by the Seller. The Seller certifies that the goods manufactured or services provided will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period.

Standard laboratory products, are warranted for twelve (12) months from the date of initial calibration, which will be referenced by supplied documentation or electronically embedded into the product's memory or both.

Specialized equipment in the form of product line additive systems, also known as "Skids" are warranted for twelve (12) months from the initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first.

Marine laboratory or deployment products, are warranted for twelve (12) months from the date of initial calibration, which will be referenced by supplied documentation or electronically embedded into the product's memory or both.

If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, correct any errors that are found by Seller in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Seller. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller. Goods repaired and parts replaced by Seller during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by Seller. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

LIMITATION OF REMEDY AND LIABILITY: Seller shall not be liable for damages caused by delay in performance. The remedies of buyer set forth in this agreement are exclusive. In no event, regardless of the form of the claim or cause of action (whether based in contract, infringement, negligence, strict liability, other tort or otherwise), shall seller's liability to buyer and/or its customers exceed the price to buyer of the specific goods manufactured or services provided by seller giving rise to the claim or cause of action. Buyer agrees that in no event shall seller's liability to buyer and/or its customers extend to include incidental, consequential or punitive damages. The term "consequential damages" shall include but not be limited to, loss of anticipated profits, revenue or use and costs incurred including without limitation for capital, fuel and power, and claims of buyer's customers.

Equipment supplied by but not manufactured by D-2 Incorporated, is supported only to the extent of the original manufacturer's original warranties. All OEM sensors which utilize electrodes (oxygen cartridges, pH, ORP, etc.) is warranted at the time of shipment, and shall perform upon initial installation within stated specifications. If the product proves to be defective within the OEM's warranty, we will replace the product or defective part with a similar model, product or part, but only to the extent that the OEM will warrant.

All returned products must be accompanied by a Returned Material Authorization (RMA) number issued by D-2 Incorporated. Shipments will not be accepted without the RMA number. An RMA number can be obtained by calling Customer Service Department at 508-329-2046 or by emailing Sales@D-2inc.com. D-2 can supply a customer return Procedure and a D-2 Service Request form which can be filled out and returned with the instrument to answer the following parameters...

Return Material Authorization Number
 Model/Serial Number
 Brief Description of the Problem
 Customer Contact/Telephone Number

CALIBRATION SERVICE POLICY

A calibration only service is available for JF-WA1 Hydro-*Light* Sensors.

The service is limited to instruments requiring only calibration and minor adjustment. Instruments that are not operating properly and require repair or replacement parts will not be covered. If repair is necessary the customer will be contacted and apprised of the additional cost. The customer will be charged the standard repair cost, which includes repair and calibration. In the event that the customer does not approve repair, the unit will be returned in "as received" condition and the teardown and inspection charge will be invoked.

APPENDIX B: Serial Port Command List

Function	Command
Save parameters	ST
List all variables	LI
Get sensor serial number	SN
Get firmware version	VR
Toggle the continuous data mode	SC
Get list of help commands	F1
Bias Mode*	PR <i>0 = ASTM BIAS Mode Not Applied</i> <i>1 = ASTM BIAS Mode Applied</i>
Optic Compensation Temp Reference	TR
Optic Slope Value (ppm/count)	N1
Optic Offset Value (ppm)	N2
Optic Temperature Coefficient (ppm/°C/ppm)	N3
Temperature Channel Offset (°C)	T1
BIAS Reading Value	M1

*all commands listed after and including this one have the ability to read or set the parameter.